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The Scottish Mathematical Council
MATHEMATICAL CHALLENGE

2011–2012

Solutions

Primary Division: Problems I

P1.1. Professor Trigg was asked how old he was.
 He replied, “If you divide my age by 2, 3, 4 or 6, there is always 1 left over, but if you divide it by 7, there is no remainder.”

How old is Professor Trigg?

Explain your reasoning.

Solution

Multiples of 2, 3, 4 and 6 are 12, 24, 36, 48, 60, 72, 84, 96, 108,

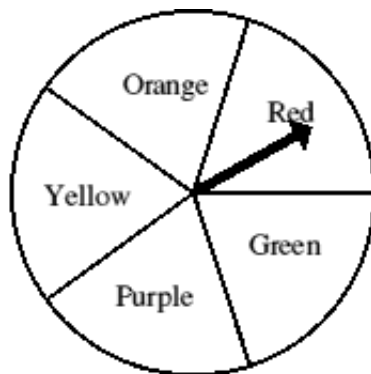
Adding 1 gives : 13, 25, 37, 49, 61, 73, 85, 97, 109

Look for a multiple of 7

Age is 49 years

The next possibility is 133 which is probably too old!

P1.2.



Adam has found a spinner which has five colours on it where each colour is equally likely to come up. Adam decides to make his own.

Adam's spinner has four colours – red, blue, orange and green. He wants it to satisfy these conditions:

- red to come up half the time;
- red to come up twice as often as blue;
- and orange to come up twice as often as green.

What fraction of the new spinner should be coloured orange?

Solution

Half the spinner must be red.

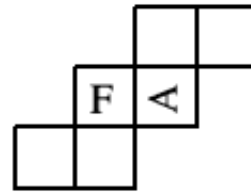
Blue is half the red region, i.e. a quarter of spinner

A quarter is covered by orange and green.

So orange is $\frac{2}{3}$ of a $\frac{1}{4}$, i.e. $\frac{1}{6}$.

P1.3.

A cube has the letters A, B, C, D, E and F marked on the faces. Below are two views of the cube. Use these to complete the net. **Describe each of your steps.**

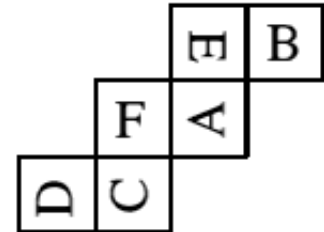
*Solution*

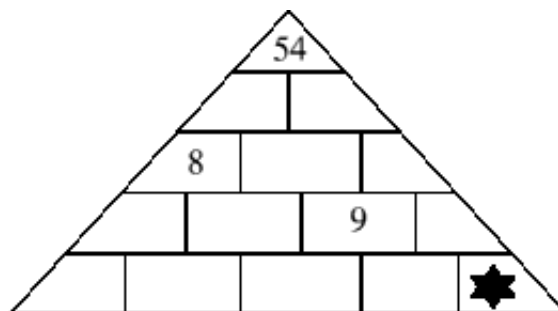
Looking at the net shown and the die on the right; since A is to the right of F, A is opposite D.

Comparing the two dice, B is opposite F. This fixes the positions of A, B, D, E and F and so C must be opposite E.

Check the orientation of the letters.

Construct the net as shown.



P1.3

In each region of the triangle shown there is a whole number, three of which are given. Each number is the sum of the two numbers immediately below it and all numbers are different. Find out which number must be in the region marked with the star and explain why.

Solution

As the numbers are all different, the smallest possible numbers in the bottom row are 1, 2, 3, 4 and 5. Thus the smallest possible number in the second row is 3.

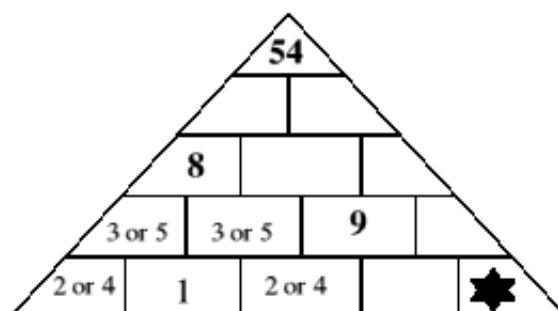
To get the 8, the cells below it must contain 3 and 5.

Below the 3, we must have 1 and 2.

Below the 5, we could have 2 and 3 or 1 and 4, but 3 cannot be repeated so 5 comes from $1 + 4$.

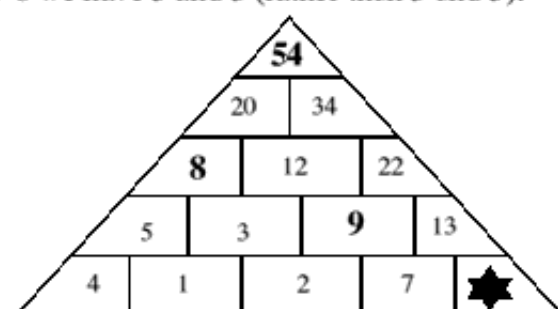
As 1 feeds into 3 and into 5, it must be directly below the 8 with 4 and 2 on either side.

So we have:



But 4 cannot feed into 9 as 5 is already used. So 4 is on the left.

This means that below 8 we have 5 and 3 (rather than 3 and 5).



The rest can now be filled in: 12, 20, 34, 13, 7 and finally the required number is 6.